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Thus, there exists a need to provide an improved mechanism for preloading data objects to a cache, wherein the aforementioned problems are substantially alleviated.

Statement of Invention

In accordance with a first aspect of the present invention, there is provided a method of preloading data on a cache in a local machine, as claimed in Claim 1.

In accordance with a second aspect of the present invention, there is provided a cache, as claimed in Claim 27.

In accordance with a third aspect of the present invention, there is provided a local machine, as claimed in Claim 28.

In accordance with a fourth aspect of the present invention, there is provided a local machine, as claimed in Claim 29.

In accordance with a fifth aspect of the present invention, there is provided a host machine, as claimed in Claim 31.

In accordance with a sixth aspect of the present invention, there is provided a host machine, as claimed in Claim 32.

In accordance with a seventh aspect of the present invention, there is provided a communication system, as claimed in Claim 33.

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In accordance with an eighth aspect of the present invention, there is provided a storage medium, as claimed in Claim 34.

Further aspects of the present invention are as claimed in the dependent Claims.

The preferred embodiments of the present invention provide a mechanism for preloading data on a cache based on a determined user behaviour profile, such that the data is made available to the cache user when the user desires.

In this manner, data within the cache is maintained in a substantially optimal state, and configured to be available to a cache user when it is predicted that the user wishes to access the data. Thus, selected items of data are cached for predicted retrieval by a cache user on an predicted demand basis, to avoid the cache memory problems and delays in downloading or preloading data to caches in known cache operations.

Brief Description of the Drawings

FIG. 1 illustrates a known data communication system, whereby data is transferred from a host machine to a cache residing in a local machine.

Exemplary embodiments of the present invention will now be described, with reference to the accompanying drawings, in which:

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Claims

1. A method (400) of preloading data on a cache (210) in a local machine (235), wherein said cache is operably coupled to a data store (130) in a remote host machine (240), the method characterised by the steps of:
- determining a user behaviour profile for said local machine (235);
- predicting (405) a time for data to be required by a user;
- retrieving data relating to said user behaviour profile from said data store (130) in response to a predicted time;
- calculating a safety margin of time; and
- preloading said retrieved data to said cache (210), at a time at or before said safety margin prior to said predicted preload time, such that said data is made available to a user of said cache when desired.
2. The method (400) of preloading data on a cache (210) according to Claim 1, wherein said step of determining is performed by a preload function (255) in said local machine 235 operably coupled to said cache and/or a preload function (265) in a remote host machine (240) operably coupled to said data store (130).
3. The method (400) of preloading data on a cache (210) according to Claim 2, the method further characterised by the step of:
- predicting, by at least one preload function, a data type required by said cache user based on said determined user behaviour profile.

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4. The method (400) of preloading data on a cache (210) according to Claim 1, the method further

~~characterised in that the step of predicting (405) is~~
performed by said at least one preload function, and
5 comprises predicting (405) an event time for said data type to be required by said user based on said determined user behaviour profile (210).

5. The method (400) of preloading data on a cache (210) according to Claim 3 or Claim 4, wherein said step of predicting includes one or more of the following steps:

predicting said event time based on said data type;

15 observing one or more previous user behaviour patterns; or

predicting said event time following a trigger on another event.

20 6. The method (400) of preloading data on a cache (210) according to Claim 3 or Claim 4, the method further characterised in that the step of predicting comprises predicting a preload time, by said at least one preload function (255, 265) based on said predicted data type.

25 7. The method (400) of preloading data on a cache (210) according to Claim 6, wherein said predicted preload time is based on one or more of the following parameters:

- 30 (i) An estimate of a cache re-load rate;
(ii) An availability of a communications network resource (155);
(iii) A previously achieved cache reload rate;

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(iv) A cost parameter of one or more available communications network resources, for example a resource at a location and/or at a time;

5 8. The method (400) of preloading data on a cache (210) according to any of preceding Claims 1 to 4, the method further characterised by the steps of:

determining (425) a current time; and

10 calculating a subsequent event or preload time therefrom.

9. The method (400) of preloading data on a cache (210) according to Claim 1, wherein said step of calculating a safety margin includes the step of:

15 predicting (410) an uncertainty of an event time, for example based on said data type and/or prevailing network conditions.

10. The method (400) of preloading data on a cache (210) according to Claim 1, wherein said safety margin is either set manually or is based on a monitoring of previous event occurrences.

11. The method (400) of preloading data on a cache (210) according to any of preceding Claims 1 to 4, wherein said event includes one or more of the following:

(i) A diarised event for said user;

(ii) A task to be performed by said user;

30 (iii) A personal interest identified for said user;

(iv) A routine behaviour pattern identified for said user;

(v) A predictable behaviour pattern identified for said user; or

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(vi) A foreseeable behaviour pattern identified

for said user.

12. The method (400) of preloading data on a cache
5 (210) according to any of preceding Claims 1 to 4,
wherein the method is further characterised by a step,
prior to said step of preloading, of:

determining and implementing a timing margin
(Tmmdg) (330) to allow for potential unavailability of
10 said communications network (155) before commencing said
step of preloading.

13. The method (400) of preloading data on a cache
(210) according to Claim 12, the method further
15 characterised by the steps of:

calculating a safety margin of time;
determining whether a predicted timing of an event is
within a time period of less than or equal to the current
time minus said safety margin and/or said timing margin;
20 and

commencing (465) said step of preloading in
response to a positive determination.

14. The method (400) of preloading data on a cache
25 (210) according to Claim 13, the method further
characterised by an intermediate step of;

determining (455) whether said cache has capacity
to store said data to be preloaded.

30 15. The method (400) of preloading data on a cache
(210) according to Claim 4, wherein the method is further
characterised by a step, prior to said step of
preloading, of:

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determining (435) a preferred maximum time (Tmpl)
(350) before said predicted event time when said step of
preloading can commence.

5 16. The method (400) of preloading data on a cache
(210) according to any of preceding Claims 1 to 4, the
method further characterised by the step of:

10 adapting one or more timing parameters (330, 350)
continuously or dynamically in response to a change in
the communication network or user behaviour profile.

17. The method (400) of preloading data on a cache
(210) according to Claim 16, the method further
characterised by the steps of:

15 applying one or more threshold values to said one
or more timing parameters (330, 350) for:

determining an acceptable cache hit rate,
and/or

determining a preload success rate, and

20 adapting said one or more timing parameters (330,
350) in response to said determination(s).

18. The method (400) of preloading data on a cache
(210) according to any of preceding Claims 1 to 4, the
25 method further characterised by the steps of:

grouping data types into categories based on, for
example, one or more of the following: said data types, a
priority of said data type, a predicted event time for
said data to be preloaded; and

30 scheduling a preloading operation of data based
on said grouping.

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19. The method (400) of preloading data on a cache (210) according to any of preceding Claims 1 to 4, the method further characterised by the step of:

determining (440) whether said cache has available capacity for receiving the preload data prior to commencing said step of preloading.

20. The method (400) of preloading data on a cache (210) according to Claim 19, wherein the step of determining whether said cache has available capacity includes measuring a rate of cache re-loads.

21. The method (400) of preloading data on a cache (210) according to Claim 8, the method further characterised by the step of:

determining (445) whether the current time is an economical time to preload said data to said cache, and in response to a positive determination, preloading said data to said cache (210).

22. The method (400) of preloading data on a cache (210) according to Claim 21, wherein the step of determining whether the current time is an economical time includes calculating whether a more economical time may be subsequently available within an acceptable preload window for said step of preloading.

23. The method (400) of preloading data on a cache (210) according to Claim 21 or Claim 22, the method further characterised by the step of:

downloading one or more cost parameters associated with one or more network resource(s) to said host machine (240) or said local machine (235) or a remote server accessible by said host machine (240) or

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said local machine (235), such that said determination of whether said current time is an economical time to preload said data to said cache (210) can be made.

24. The method (400) of preloading data on a cache (210) according to any of preceding Claims 1 to 4, wherein said step of preloading includes:

preloading said retrieved data in said cache (210), based on said user behaviour profile for said local machine (235), only when network costs are inexpensive, such that said data is made available to said cache user when desired at a substantially minimised cost.

25. The method (400) of preloading data on a cache (210) according to any of preceding Claims 1 to 4, the method further characterised by the step of:

determining (450) whether a communications network (155) to be used in said preloading step is busy or whether said communications network (155) would be overloaded when commencing the preload operation, and in response to a positive determination delaying said step of preloading said cache (210).

26. The method (400) of preloading data on a cache (210) according to Claim 25, wherein, in response to determining that the communications network (155) is busy or would be overloaded, the method is further characterised by the steps of:

scheduling an entire preload operation for periods when the communication network is not busy; or scheduling said step of preloading on a block-by-block basis that provides intervals between said blocks for other users to use said communications network (155).

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27. A cache (210) preloaded in accordance with Claim 1.

28. A local machine (235) characterised by a cache
5 preload function (255) operably coupled to a cache (210)
that is preloaded in accordance with Claim 1.

29. A local machine (235) comprising:

10 a local communication unit (115) for operably
coupling said local machine to a host machine (240) via a
communication network (155); and

a cache (210) operably coupled to said local
communication unit (115);

the local machine (235) characterised by:

15 a preload function (255), operably coupled to
said cache (210), for determining a user behaviour
profile for said local machine (235), predicting a time
for data to be required by a user; calculating a safety
margin of time retrieving data relating to said user
20 behaviour profile from said data store (130) in response
to said predicted time, and preloading data on said cache
(210) based on said user behaviour profile, at a time at
or before said safety margin prior to said predicted
preload time, such that said data is made available to
25 said cache user when desired.

30. The local machine (235) according to Claim 28 or
Claim 29, wherein said local machine (235) is a personal
digital assistant configured to communicate over, for
30 example, a General packet radio network wireless network
to a remote host machine (240).

31. A host machine (240) comprising:

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a host communication unit (120) for operably coupling said host machine (240) to a local machine (235) via a communication network (155); and

a data store (130), operably coupled to said host communication unit (120);

the host machine (240) characterised by:

a preload function (265), operably coupled to said data store (130), for determining a user behaviour profile for said local machine (235), predicting a time for data to be required by a user, calculating a safety margin of time, retrieving data relating to said user behaviour profile from said data store (130) in response to a predicted time and preloading data from said data store (130) to a cache (210) on said local machine (235) based on said user behaviour profile, at a time at or before said safety margin prior to said predicted preload time, such that said data is made available to a user of said cache when desired.

32. A host machine (240) characterised by a data preload function (265) operably coupled to a data store (130), for performing the cache preload steps according to Claim 1.

33. A communications system (200) adapted to support the method (400) of preloading data on a cache (210) in a local machine (235) according to Claim 1 or comprising a local machine (235) according to Claim 29 or Claim 30 or a host machine (240) according to Claim 31 or Claim 32.

34. A storage medium storing processor-implementable instructions for controlling a processor to carry out the method of Claim 1.

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